QUALITY CONTROL

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THE PROCESS APPROACH AND STATISTICAL METHODS IN QUALITY CONTROL OF HARDENED GLASS

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A process model of production of hardened glass was constructed. The efficacy of using statistical methods of control and regulation for increasing the quality of the processed glass was demonstrated.

The competitive environment in market conditions is causing the managers of glassworks to focus great attention on problems of quality. There is a direct correlation between quality and production efficiency. Increasing the quality increases the efficiency of production, reduces costs, and increases market share.

Bor Glassworks has positive experience in satisfying the requirements and expectations of consumers in Russia and CIS countries in ensuring high quality of automobile glass.

The current theory of quality control is based on the following assumption: quality control activity must be conducted during product production. Activity to ensure quality preceding the production process is also important. Quality is determined by the effect of many random and subjective factors. To prevent the effect of these factors on product quality, a quality control system that constantly acts on the product creation process to maintain the corresponding quality level is created.

Modern hardened glass technology is a continuous process consisting of successive manufacturing operations (processes): cutting and processing the glass stock, hardening the glass, packaging the finished product, and controlling unsuitable products.

The processes that take place in production can be adequately represented by modeling, which allows representing all of the many production processes in the form of a set of diagrams that reflect the processes and operations executed and also correlate their material and data streams and required resources.

We used IDEF0 methodology for creating a process model for production of hardened glass due to its clarity, instrumental tools, and simplicity of comprehension [1].

The IDEF0 model is a hierarchically organized set of diagrams. The top-level diagram contains one block A0-0, forming a context diagram of the model of the manufacturing process for production of hardened glass (Fig. 1).

This block represents the overall manufacturing process for production of hardened glass. It first serves as a parent diagram for the other diagrams and states the overall function of the entire diagram — "To produce hardened glass." Second, it gives a host of the basic types of data required in conducting the production process. For example, standards, instructions, specifications, and control programs allow managing the quality of the hardened glass. Third, the diagram indicates the interrelations between the basic types of data, marking their limits. For example, user requirements (information), glass stock, and auxiliary materials are considered as process input data, while production personnel and process equipment carry out the processes. The process output data are the qualitative product, information on its quality, and production wastes.

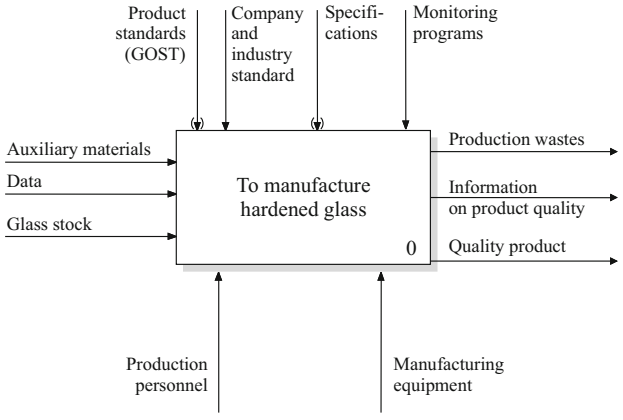

Fig. 1. A0-0 "To manufacture hardened glass."

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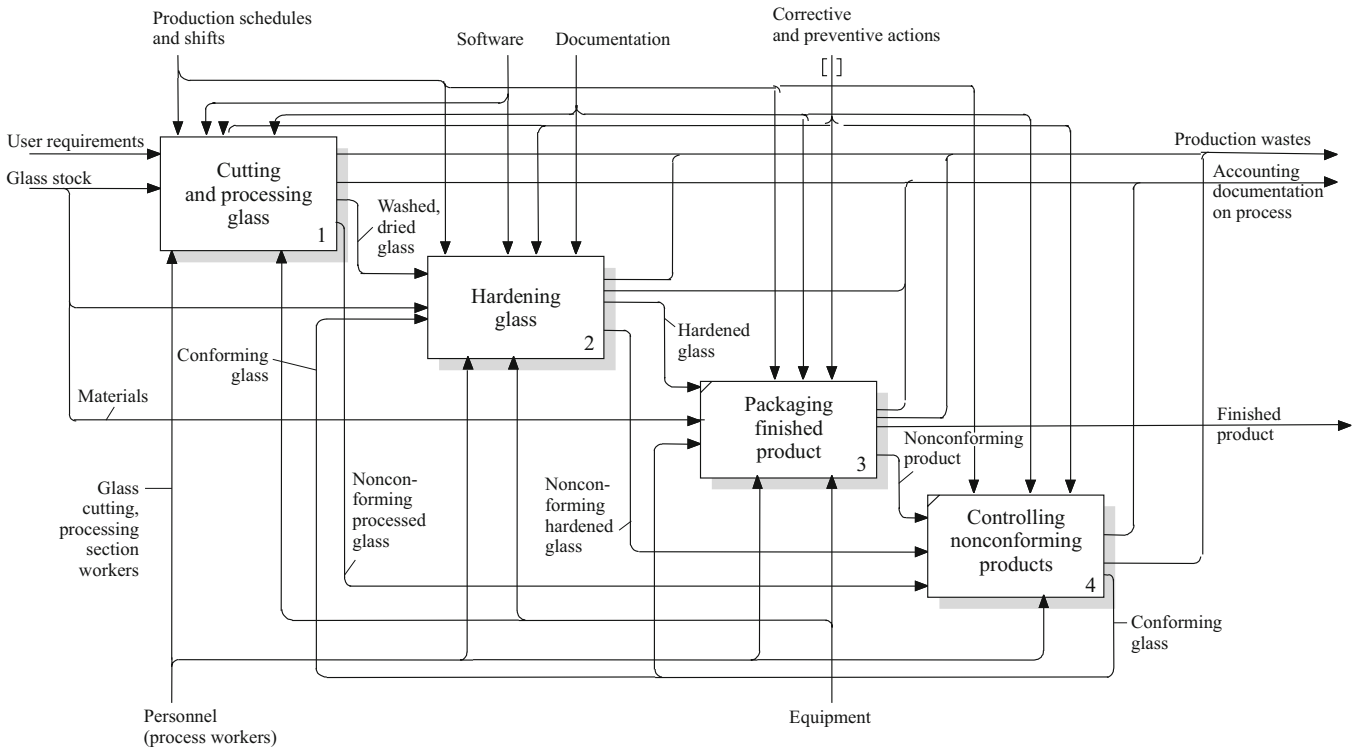

Fig. 2. A00 "To produce hardened glass."

The developed model unfolds during structural decomposition from top to bottom. The upper level diagram is broken down, forming diagram A00, which consists of four blocks: "Cutting and processing the glass," "Hardening the glass," "Packaging the finished product," "Controlling nonconforming product" (Fig. 2). Each block in the diagram is

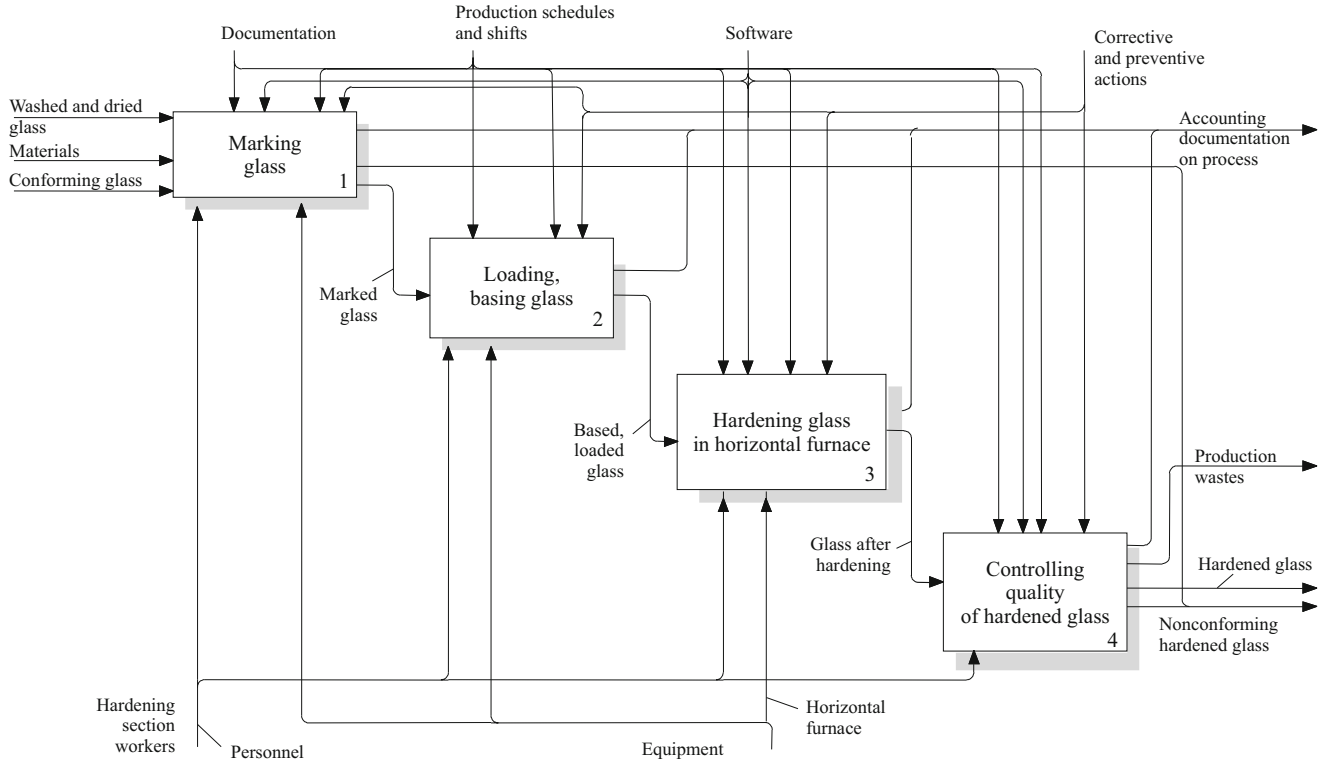

Fig. 3. A2 "Hardening Glass."

considered as an individual block and is broken down (Fig. 3). In turn, block A2 (“Hardening the glass” is broken down into sub-blocks A23 “Hardening glass in a horizontal furnace,” which is also broken down into operation A232 “Pressing the glass,” etc.

The next stage after constructing the production process model was to determine the trackability of the product over the entire manufacturing chain. Each section of the production process was analyzed with respect to how it affected the quality of the processed hardened glass. The problem of adjusting the processes to ensure stability of results was solved based on the result of analyzing the process model. Such measures as process quality control and use of statistical methods of analysis were developed. SMTs Prioritet Ltd. (Nizhny Novgorod) was of great assistance in introducing the statistical methods in production.

The final goal of the executed measures was to reduce the defect level, increase the efficiency and efficacy of correcting the hardened glass production process, increase the objectivity of control, and stimulate and motivate the workers engaged in the processes. Attaining these goals was controlled by shop schedules by including result indexes in these schedules: percentage annual production output, equipment utilization factor during working time, product output per unit of time, etc.

Periodic meetings are an important element of systemic control of production of hardened glass with the process approach. The results of the processes are examined, and the production estimates issued to users are analyzed at these meetings. Based on the results of the estimates, management develops corrective and predictive actions which are included in the shop schedules.

Introduction of systemic control based on the process approach and use of statistical methods of controlling and regulating production of hardened glass allowed increasing product quality, which reduced production losses.

REFERENCES

1. David A. Marca and Clement L. McGowan, *SADT: Structured Analysis and Design Technique*, McGraw-Hill, New York (1987).